Investment in malaria elimination: a leap of faith in need of direction

See Articles page e98

The decrease in malaria burden in the past decade has coincided with a greater than 15-times increase in international spending on malaria control[1] and a shift in approach towards a goal of local elimination in many endemic countries. Although investment growth rates have slowed, the decrease in malaria transmission is expected to continue, with some indications that these gains are more resilient than expected.[2]

In *The Lancet Global Health*, Ubydul Haque and colleagues[3] assess the performance of the Bangladesh National Malaria Control Program (NMCP) in delivering malaria control activities in the country's remaining endemic areas after 5 years of investment from the Global Fund to Fight AIDS, Tuberculosis and Malaria. The analysis has several strengths and weaknesses that are informative for economic assessments of malaria control programmes in countries moving towards elimination.

From an economic perspective there are three points of relevance to investment in malaria elimination. First is that of allocative efficiency—whether this is the best use of scarce resources. Second is the identification of the most efficient configuration of interventions to meet the aim of elimination, and third is the technical efficiency in implementation of these interventions. Haque and colleagues focus mainly on the third question, with some extension to the effectiveness of interventions in reducing transmission.

With regard to allocative efficiency, although malaria elimination is a laudable cause, the intuitive economic case for it is not well substantiated compared with support for continuing control;[4,5] as the burden of malaria continues to decrease, the argument for elimination will also become progressively less compelling compared with investment in other causes of illness. The economic case is further complicated by difficulties in quantification of the probability of success and the effect of factors that affect the likelihood of success, notably the spread of artemisinin resistance or a resurgence of malaria, which are affected by uncertain factors such as future land use, climatic changes, and economic development. Despite these uncertainties, the political will and donor support for elimination are well established, so economic assessments are best focused on how to direct resources towards this aim.

Estimation of the effectiveness of malaria control in achieving elimination is challenging. Effective control has reduced malaria in regions of low transmission, but other processes have also contributed, including deforestation, urbanisation, rising incomes, and improved access to health care.[2,6] Haque and colleagues draw attention to the association between insecticide-treated net (ITN) coverage and decreasing prevalence of malaria (prevalence rate ratio for any malaria with >0·50 ITN per person 0·79 [95% CI 0·77–0·81]), and an even larger decrease in mortality (0·24 [0·09–0·65]). Was this association causal or coincidental? Improved ITN coverage is indicative of greater support for all aspects of malaria control, notably early diagnosis and effective treatment. Furthermore, the disproportionate reduction in mortality compared with malaria cases identified by Haque and colleagues suggests that provision of artemisinin combination treatments might well have been a major contributor to the decreased mortality, and could also have reduced transmission.[7,8] In one of the largest ever studies of ITN efficacy,[9] done in Rakhine State, Myanmar (adjacent to the study area of Haque and colleagues), ITNs were shown to have little antimalarial efficacy largely because of the early biting exophilic behaviour of the main malaria vectors.

An understanding of the extent to which malaria control as a whole or any specific intervention contributes to lowering of transmission cannot be derived reliably from historical associations between intervention coverage and decreasing transmission. Assessments of malaria control programmes might therefore be best focused on their technical efficiency in delivery of predefined objectives based on robust study designs.

Haque and colleagues provide a positive example of how an assessment of technical efficiency should be done. Costs of malaria control activities were estimated using donor and NMCP budgets (their financial costs), a practice that is often deemed less adequate than using the societal opportunity cost. Although economic costs are needed to estimate the allocative efficiency of interventions, in this context financial costs provide

donors with the information most relevant to their perspective. Combination of financial costs with programmatic outputs, such as ITN coverage and health education per person per year, enables donors to gauge and compare how efficiently their funding is being used in different countries. Use of other downstream outcomes including the cost per case treated or extension to measures such as disability-adjusted life-years (DALYs) or deaths averted is not warranted because as malaria transmission and incidence fall, the relative cost per case treated (or DALY averted) will rise exponentially, penalising effective programmes.

Donor funding for malaria elimination has increased substantially out of a belief that this investment is worthy. The most pressing and challenging need is to identify optimum configurations of interventions to achieve elimination. Well designed intervention studies can offer some such guidance but these are mostly limited to one intervention and setting. Economic–epidemiological models can simulate the effect of configurations of interventions to achieve elimination as quickly as possible, subject to budget constraints. National malaria control programmes are best assessed on their technical efficiency in delivering these objectives, and need not rely on uncertain associations between their activities and health outcomes, or their allocative efficiency as compared with alternative uses of these resources.

Yoel Lubell
Mahidol-Oxford Tropical Medicine Research Unit, Faculty of Tropical Medicine, Mahidol University, Ratchathewi District, Bangkok 10400, Thailand; and Centre for Tropical Medicine, Centre for Clinical Vaccinology and Tropical Medicine, Churchill Hospital, Oxford, UK
yoel@tropmedres.ac

I declare that I have no conflicts of interest. I thank Nicholas White for his very helpful input on this commentary.

1 WHO. World Malaria Report 2013. Geneva: World Health Organization, 2013.
2 Smith DL, Cohen JM, Chiyaka C, et al. A sticky situation: the unexpected stability of malaria elimination. *Philos Trans R Soc Lond B Biol Sci* 2013; **368:** 20120145.
3 Haque U, Overgaard HJ, Clements ACA, et al. Malaria burden and control in Bangladesh and prospects for elimination: an epidemiological and economic assessment. *Lancet Glob Health* 2014; **2:** e97–104.
4 Mills A, Lubell Y, Hanson K. Malaria eradication: the economic, financial and institutional challenge. *Malar J* 2008; **7** (suppl 1)**:** S11.
5 Sabot O, Cohen JM, Hsiang MS, et al. Costs and financial feasibility of malaria elimination. *Lancet* 2010; **376:** 1604–15.
6 Tusting LS, Willey B, Lucas H, et al. Socioeconomic development as an intervention against malaria: a systematic review and meta-analysis. *Lancet* 2013; **382:** 963–72.
7 Maude RJ, Hasan MU, Hossain MA, et al. Temporal trends in severe malaria in Chittagong, Bangladesh. *Malar J* 2012; **11:** 323.
8 Okell LC, Drakeley CJ, Bousema T, Whitty CJ, Ghani AC. Modelling the impact of artemisinin combination therapy and long-acting treatments on malaria transmission intensity. *PLoS Med* 2008; **5:** e226.
9 Smithuis FM, Kyaw MK, Phe UO, et al. The effect of insecticide-treated bed nets on the incidence and prevalence of malaria in children in an area of unstable seasonal transmission in western Myanmar. *Malar J* 2013; **12:** 363.